Caries Risk Assessment and Prevention: Strategies for Head Start, Early Head Start, and WIC

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Abstract

Objectives: *This review updates the evidence regarding caries risk assessment for infants, toddlers, and preschool children and formulates recommendations for preventive strategies for WIC, Head Start, and Early Head Start.* ***Methods:*** *Literature on caries risk assessment and preventive strategies for infants, toddlers, and preschool children were reviewed and synthesized. Recommendations for WIC, Head Start, and Early Head Start were made based on the review.* ***Results:*** *Individual caries risk for children in WIC, Head Start, and Early Head Start should be based on: (1) previous caries experience, (2) precavity lesions, (3) visible plaque, and (4) perceived risk by examiners. Recommended preventive strategies for WIC and Head Start populations include: (1) daily toothbrushing in Head Start centers using fluoridated toothpaste; (2) fluoride varnish application to children enrolled in WIC, Head Start, and Early Head Start; (3) use of chlorhexidine gels and varnishes (following FDA approval); and (4) increased use of sealants on children with precavity pit and fissure lesions.* ***Conclusions:*** *Early screening, risk assessment, and preventive programs in WIC, Head Start, and Early Head Start populations hold a great deal of promise for preventing dental decay in high-risk children. [J Public Health Dent 2000;60(3):210-17]*

Key Words: dental caries, prevention, early childhood caries, Head Start, WIC, risk assessment.

In a 1995 landmark article, Edelstein and Douglass successfully dispelled the myth that tooth decay is no longer a serious public health problem for US children (1). While the prevalence of dental decay has declined dramatically for many children, tooth decay remains one of the most common diseases of childhood (2). Of further concern is the fact that in the United States, dental decay in children is distributed unevenly. An estimated 80 percent of decay is found in just 25 percent of children (3). Children from low-income families are disproportionately affected and are affected at an early age (1). Caries rates among children aged 3 to 5 years attending Head Start preschool programs, for example, typically range from 16 percent to 65 percent (1). Caries rates of 35 percent to 56 percent have been reported for children under the age of 3 years enrolled in Women, Infants, and Children (WIC) programs (4,5).

To reduce caries rates among high-risk children, it is important that preventive dental programs and strategies be put into place to overcome barriers that have reduced the ability of preventive efforts to reach lower income groups in the past. Because many high-risk children in this country are served by Head Start and WIC, these programs appear to provide the ideal infrastructure in which to implement preventive dental protocols and strategies. Not only are these programs dedicated to serving low-income children, but they already have an established commitment to the oral health of the children they serve.

Project Head Start is the largest preschool program in the United States, serving primarily children from low-income families and children with disabilities. Established in 1965, Head Start is administered by the Department of Health and Human Services. More than 800,000 children are served annually by Head Start, with a goal of 1 million children per year by 2002. Children enrolled in Head Start traditionally have been 3 to 5 years of age. In 1994 the Head Start Reauthorization established "Early Head Start," a new program for low-income pregnant women and families with infants and toddlers.

The WIC program originated in 1972, when an increased awareness of the nutritional needs of pregnant women and preschool children led Congress to authorize the Special Supplemental Food Program for Women, Infants, and Children. WIC is administered by the US Department of Agriculture (USDA) and provides nutritional screening, vouchers for nutritious food, nutrition education, and health and social service referrals for eligible low-income women and children up to the age of 5 (6). Nationwide, WIC serves approximately 7.5 million people annually.

This paper will suggest strategies for identifying children at high risk for dental decay within Head Start and WIC programs, and outline methods and procedures for preventing tooth decay in these children. It will not provide a comprehensive review of either risk assessment or prevention, but instead will focus on specific methods of risk assessment and prevention that are low-cost, evidence-based, and that could be implemented in Head Start and WIC programs with anticipated success.

Screening Activities

Oral screening exams for the infant, toddler, or preschool child are an important first step in determining a child's oral health care needs. Screening exams can provide information regarding the presence of abnormalities and pathology, including dental caries. Screening exams also provide an opportunity to assess the risk for future caries and recommend individual strategies for preventing disease. Fur-

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ther, when parents are present, screening exams can provide "teachable moments" that allow for preventive instruction and anticipatory guidance.

The American Academy of Pediatric Dentistry (AAPD) recommends that children have their first exam by a dentist at age 1 or within 6 months of the eruption of the first tooth. To provide risk assessment and anticipatory guidance for high-risk groups, periodic oral examinations should begin even earlier. Although dental exams traditionally have been provided by dentists, finding a dentist willing to see children at age 1 is difficult. Studies in Iowa and Texas have found that only 26 percent and 19 percent of dentists, respectively, are willing to provide dental exams to children this young (7,8). For older children, access to a dentist also may be difficult, especially if children are enrolled in Medicaid. A recent study of Head Start programs in Iowa found that 28 percent of Head Start preschool children in the state are unable to obtain dental examinations for their children within 90 days, a Head Start performance standard (9). The primary reason cited by programs for not meeting this standard is a shortage of dentists willing to accept new Medicaid patients into their practices.

Where dentists are either unavailable or unwilling to perform dental screening exams on young children, screenings by dental hygienists, physicians, nurses, and other health professionals should be encouraged. Oral screening exams can take place in conjunction with other health assessments and interventions for children enrolled in Early Head Start and WIC. Typically, no separate appointments are necessary. In Head Start programs, screening exams can be done on site by dentists, hygienists, or other appropriately trained health professionals. Screenings typically can be carried out with a minimum of armamentarium including a mouth mirror, toothbrush, rubber gloves, and a light source. The protocol for examining infant patients has been described previously (10).

Whenever possible, a routine referral to the dentist should take place for each child screened in Head Start, Early Head Start, and WIC programs. The primary goal for referring all children is to establish a dental home for each child where they can receive comprehensive diagnostic, preventive, restorative, and emergency care throughout childhood.

Caries Risk Assessment

Because a disproportionate amount of decay is found in children from lower income families who have difficulty in accessing dental care, prevention for these children is especially important. An essential first step, given limited resources, is to determine, upon screening, which children are at high risk for dental decay and which are not (11). Based on a determination of caries risk, different preventive strategies can be employed for children in different risk categories. While certain preventive strategies may be appropriate for virtually everyone in a group or population, others are more costly or time consuming, and can therefore be targeted toward children at highest risk.

Because most children served by Head Start and WIC are from low-income families, children enrolled in these programs should be considered at higher risk in general than other children. Evidence supports a strong association between sociodemographic factors including income, and risk for dental caries in children (12,13). Studies of Head Start preschool children have reported decay rates frequently exceeding 60 percent (1), a rate much higher than in the general population. Tinanoff reported that caries prevalence in Head Start children in a community in Connecticut was 34 percent higher than the prevalence among middle class children in the same community (14).

While as a group, children enrolled in Head Start and WIC can be considered at higher risk for caries than the general population, it is still important to conduct caries risk assessments at the individual level. Not all low-income children experience similar levels of disease, and with individual caries risk assessment, higher cost interventions can be targeted appropriately to individuals at highest risk. Many different risk factors for caries have been explored, and models for risk assessment have been tested. (For a more comprehensive report on caries risk assessment, see ref. 14.) However, no strategy for predicting caries risk is 100 percent accurate.

Risk assessment strategies that are most applicable for use in Head Start, Early Head Start, and WIC programs include those that are easily performed, low cost, require no special equipment or supplies, and promise to provide reliable results. Indicators of caries risk meeting these criteria include: previous caries experience, presence of precavity lesions (white spot lesions and stained fissures), visible plaque, and examiner's overall impression of caries risk status. Screening tests for mutans streptococci also should be considered. Although they require an increased level of sophistication and expense, they provide one of the best available indicators of caries risk. One additional indicator of caries risk in young children is bottle-feeding behavior. While not as predictive as other risk indicators, prolonged exposure to sweetened liquids in a bottle should be considered when assessing caries risk.

Previous Caries Experience. One of the best predictors of future caries is past caries experience (15-19). With children under the age of 5 years, a history of previous dental decay automatically should classify a child as "highest risk" for future decay. Steiner et al. (19) evaluated a comprehensive set of variables in an effort to identify the best predictors of caries in children and found that a history of caries in the primary teeth was the best and most consistent predictor of future caries. The importance of caries experience as a predictor of future caries also was found by Reisine et al. (15). They followed 184 children aged 3–5 years in two Head Start programs in Connecticut and found that dmfs was one of the most important predictors of future decay.

Precavity Lesions (White Spot Lesions and Stained Fissures). While previous caries experience is the best predictor of future caries experience, many young children who are at high risk for dental caries may have no previous caries experience simply because the disease has not had time to express itself. This situation is especially true for children under the age of 3 years.

White spot lesions are the immediate precursors to cavitated lesions and generally appear on the smooth surfaces of teeth, close to the gum line, where plaque tends to accumulate. White spot lesions should be considered equivalent to caries when determining caries risk in young children. Unfortunately, many dental professionals and others do not routinely screen children for white spot lesions. Recently, educational aids have become available that assist parents and health professionals in evaluating children for the presence of white spot lesions. A videotape titled "Lift the Lip: How to Check Infants' and Toddlers' Teeth" has been developed in Washington State and clearly demonstrates the importance of early identification of white spot lesions (the video is available in both English and Spanish through Continuing Dental Education, University of Washington, Seattle, WA).

While precavity lesions on smooth surfaces generally appear as white spots, precavity lesions in pits and fissures generally appear as brown or black staining that cannot be removed with a toothbrush. The ability of discolored pits and fissures to predict future caries in permanent molars has been documented in the literature (19). Pit and fissure surfaces of primary teeth do not ordinarily appear stained; thus, the appearance of stained pit and fissure surfaces in primary molars should be viewed as indicative of increased caries risk, although this clinical characteristic has not been well documented in the literature.

Visible Plaque. The presence of visible plaque on the teeth of young children can be used as an indicator of caries risk. Alaluusua and Malmivirta (20) followed 92 19-month-old children for a period of 1 1/2 years and found that among variables tested, visible plaque was the best predictor of future caries risk. Other factors considered included the use of a nursing bottle, mother's DMFT, and mother's salivary level of mutans streptococci. Ninety-one percent of the children in this study were correctly classified as to caries risk solely based on the presence or absence of visible plaque. The potential for visible plaque to be an accurate predictor of caries risk in very young children is encouraging because screening for this variable can be done relatively easily and at little or no additional cost.

Perceived Risk by Dental Professional. The ability of dentists, hygienists, and other health professionals to predict caries risk status with a high degree of reliability has been documented in the literature. A study by Alanen et al. (21) evaluated the ability of 77 examiners to predict (following examination and treatment) whether children (n=7,917) aged 5–16 years would develop new dental caries during the following 12 months. Some clinicians were able to predict caries risk with high levels of sensitivity and specificity. The authors concluded that experienced practitioners are reasonably able to predict caries risk without the use of "time- or money-consuming methods." Similar results supporting the ability of dentists to accurately predict caries risk were found by Disney et al. (22) and Isokangas et al. (23). The ability of hygienists and other nondentist health professionals to accurately predict caries risk also has been documented (22,24).

Screening Tests for Mutans Streptococcus. Mutans streptococci *(S. mutans)* is a group of microorganisms present in plaque and necessary for caries to develop. Because of the well-established relationship between mutans streptococci and dental caries, biological tests that screen for the presence and levels of mutans streptococci have been advocated as important risk indicators. Edelstein and Tinanoff (25) found promising results in their evaluation of a caries-screening test in a group of children under age 6 years. The screening test consisted of sampling individual children's saliva using a sterile tongue blade, then impressing the tongue blade onto a selective culture media and incubating the media for 48 hours. They found that 93 percent of children with caries tested positive on the mutans streptococci culture and that 95 percent of uninfected children were caries free.

Screening for the presence of mutans streptococci involves a higher level of sophistication, equipment, and cost than do other screening methodologies; however, the potential advantages of this screening tool make it attractive for use in high-risk populations. Screening mutans streptococci levels offers to provide an excellent outcome measure to determine the effectiveness of preventive protocols. If efforts were implemented to reverse caries risk in pregnant women or young mothers, for example, mutans streptococci testing would allow for the ability to document success. Further, mutans streptococci testing of infants in WIC clinics might provide the earliest objective indicator of risk because early infection of infants with mutans streptococci and high levels of mutans streptococci are known to be associated with increased caries risk (26).

Sleeping with a Bottle. Sleeping with a nighttime bottle containing sweetened liquids (and/or prolonged ad lib use of a bottle or sippy cup during the day) has long been considered a risk factor for caries in early childhood. Controversy regarding the exact relationship between bottle content and caries has developed recently; nevertheless, the importance of this variable in predicting caries risk deserves mention (27). Because of the multifactorial nature of caries, some children will use the bottle inappropriately and not develop caries, while others with high levels of *S. mutans* may develop extensive caries. Alaluusua and Malmivirta (20) found that only 33 percent of 19-month-old children who reportedly used a nighttime nursing bottle developed caries in a 1 1/2 year period of time. While bottle-feeding behavior alone may be insufficient evidence to characterize a child as high risk for dental caries, when combined with other risk indicators, it should be considered significant. Information about bottle-feeding behaviors can be obtained through parent interview, and through direct observation as children often present to appointments with bottles of juice, Kool-Aid, or other sweetened beverages.

Prevention

Following screening and risk assessment, preventive protocols should be prescribed and implemented. As previously stated, most children served by Head Start, Early Head Start, and WIC can be considered at high risk for dental decay, and therefore most recommended preventive protocols will be appropriate for nearly everyone in these programs. Some protocols, however, will best be reserved for individuals found to be at highest risk for dental caries due to the time and cost associated with them.

The preventive modalities that will be discussed in the following section include education, toothbrushing, fluoride varnishes, sealants, and chlorhexidine varnishes and gels. This review is not intended to be comprehensive, but rather will focus on preventive strategies that lend themselves to implementation in Head Start, Early Head Start, and WIC programs. For a more comprehensive review of caries prevention, the reader is referred to Chapters 23–27 in "Dentistry, Dental Practice, and the Community" by Burt and Eklund (28).

Education and Decay Prevention. The mainstay of many preventive dentistry programs has been education—education about the etiology of tooth decay and education regarding ways to prevent it. Most educational messages about oral health are persuasive in nature. They attempt to persuade the listener to adopt healthy behaviors and to discontinue unhealthy behaviors. Specific examples in dentistry include attempting to persuade mothers to stop putting their children to bed with a bottle, or attempting to persuade parents to brush their children's teeth thoroughly on a daily basis. Little evidence, however, supports the effectiveness of education and counseling in preventing tooth decay (14).

A study by Bird and Hazel (29) investigated whether parental education regarding appropriate oral hygiene could have an impact on the oral health of their children. One-hour lectures were given to parents of Head Start preschool children regarding the etiology of decay, the effectiveness of plaque control, and on brushing and flossing techniques. Parents were counseled about the importance of parental involvement with their children's oral hygiene. The children's oral hygiene in this study did not improve during the study and the authors concluded that education of the parents for the children's benefit had little effect.

As discussed previously, one potentially deleterious habit regarding the oral health of children is sleeping with a bottle containing sweetened liquids. A significant amount of research has been done in this area, with results consistently demonstrating the limits of education in behavior change. In a study by Benitez et al. (30), 17 parents of children with early signs of ECC received one-on-one counseling regarding the harmful effects of sleeping with a bottle containing sweetened liquids. All subjects were advised to wean their children from nighttime use of the bottle, or to substitute water in the bottle. Parents also were given a 0.4 percent SnF_2 gel with instructions to apply it to their child's teeth twice daily following brushing. Three months following the initiation of the study, however, it was discontinued due to low levels of compliance among participants. Only seven of the participants had successfully weaned their child from the bottle. Only two had followed the recommendations for applying the SnF_2 gel. In the majority of cases, the decay had progressed significantly. The authors concluded, "Education and instruction may not be effective in altering inappropriate habits or improving preventive behaviors in some populations."

A review of dental health education outcomes, as summarized in the fifth edition of Burt and Eklund's text (28) "Dentistry, Dental Practice, and the Community" revealed: "(a) educational programs work well at improving knowledge levels; (b) they have a positive, but temporary, effect on plaque levels; and (c) [they] have no discernible effect on caries experience." Despite these limitations, oral health education undoubtedly remains an important component of preventive dental programs. Efforts designed to improve the ability of educational messages to alter behavior and improve oral health should be encouraged.

Toothbrushing and Decay Prevention. The importance of toothbrushing in the prevention of tooth decay has long appeared to be self-evident. Dental professionals and their patients have shared a common understanding that, to reduce caries risk, individuals simply need to brush better and more often. Little evidence, however, supports the notion that people can reduce their caries risk by toothbrushing alone. The relationship between individual oral hygiene status and caries experience is weak, and instructional programs designed to reduce caries incidence by promoting oral hygiene have failed (31-34).

Evidence suggests "the main purpose of regular toothbrushing, in terms of caries prevention, is to introduce fluoride into the mouth regularly via the toothpaste" (28). The decay-reducing benefits of fluoride have been documented extensively in the scientific literature. While little literature supports the use of toothbrushing alone for decay prevention, there is convincing evidence to support the decay-preventing benefit of toothbrushing with a fluoride-containing toothpaste.

Two recent publications based on a single study demonstrated that daily toothbrushing with fluoride toothpaste in 3–6-year-olds attending kindergarten in southern China significantly slowed caries development (35,36). After three years the dmfs score for children who brushed daily with fluoridated toothpaste was 36 percent lower on average than the dmfs score of children in a control group. Further, 28 percent of carious lesions that were identified at baseline in the experimental group and had gone untreated had become arrested. This finding was even more pronounced in anterior teeth, where 45 percent of decayed mesial and distal surfaces became arrested. The authors acknowledged that in developed countries, restorative dental care for carious lesions extending into dentin is the norm, but went on to suggest that in developing countries where there is a severe shortage of dental personnel, preventive programs involving daily brushing with a fluoride toothpaste may be able to arrest and reharden carious teeth that do not receive restorative treatment. Toothbrushing in this study was carried out by the children using a simple scrub technique after lunch each day. A teacher or supervisor dispensed a small amount of toothpaste (0.2–0.4 g) onto each child's brush, and the children brushed for two to three minutes, rinsed with water, and expectorated.

Holtta and Alaluusua (37) also found that daily supervised brushing with fluoridated toothpaste could reduce caries incidence in 3–6-year-old children. They found a 66 percent reduction in decay increment over a two-year time period for those brushing with a fluoridated toothpaste compared to a retrospective control group that brushed daily, but without fluoridated toothpaste.

Sjögren et al. (38) reported on the caries-reducing effect of a modified toothpaste technique in preschool children. The technique consisted of dispensing toothpaste onto the toothbrush, spreading the toothpaste evenly on the teeth, and brushing for two minutes. Children were asked to spit no more than necessary following brushing and only 10 ml of water were used to rinse before spitting. No eating, drinking, or additional rinsing were allowed for two hours after brushing. This modified technique reduced cavities between the teeth of preschool children by an average of 26 percent compared to a control group who also brushed with a fluoride toothpaste, but received no instructions restricting rinsing. Other studies by the same author have confirmed that rinsing after brushing with a fluoride toothpaste should be kept to a minimum or eliminated altogether to maximize the beneficial effect of the fluoride contained in the toothpaste (39-41).

These findings lead to the conclusion that preventive programs involving toothbrushing, especially when conducted with children at high risk for dental caries, should be carried out using a fluoride toothpaste, followed by minimal or no rinsing. If brushing with this protocol takes place with young children, ingestion of fluoride and the potential for dental fluorosis (which may cause esthetically objectionable discoloration of the permanent teeth) must be taken into consideration. A recent study by Bently et al. (42) reported that 30-month-olds will ingest 72 percent of the toothpaste applied to a toothbrush. Other studies with young children have found that an average of 59 percent and 65 percent of toothpaste applied to the brush is ingested (43,44). If the amount of toothpaste dispensed is carefully controlled, the amount of fluoride ingested will be relatively low, however. For example, if a pea-sized amount of toothpaste is used when brushing, the amount of fluoride contained on the toothbrush will be 0.25 mg or less. It could still be a contributing factor to fluorosis, however, for children ingesting more than the average amount, or for children ingesting significant amounts of fluoride from other sources. The critical time period during which maxillary permanent central incisors are at highest risk for fluorosis is during a four-month period beginning around age 22 months (45). The risks for fluorosis must be weighed against the risk for caries, however, and in vulnerable populations including children served by Head Start and WIC, the potential benefits of daily brushing with toothpaste may outweigh any potential risk for fluorosis.

Fluoride Varnish and Decay Prevention. Topical fluoride treatments have been given to children for many years, and traditionally have consisted of four-minute applications of a fluoride gel held in contact with the teeth using foam trays. This method of fluoride application is effective in reducing the incidence of dental caries in older children, but the recommended protocol is virtually impossible to complete with infants, toddlers, and many preschool-aged children.

Fluoride varnish is ideally suited for application to the teeth of young pediatric dental patients because of its ease of application. Fluoride varnish was first introduced to the United States in 1991 when Duraflor® became available on the market. A second fluoride varnish, Duraphat®, was introduced in 1997. Fluoride varnish has been widely used in Europe for more than 30 years and has proven effective in preventing tooth decay in both the primary and permanent dentitions (46). An early study by Holm (47) demonstrated the caries-preventive effect of fluoride varnish on primary teeth. In this study, 225 3-year-old children received a semiannual application of fluoride varnish (Duraphat®). After two years, the caries reduction achieved was 44 percent compared to a control group. Based on its effectiveness and ease of application, the author recommended fluoride varnish as a caries-preventive method for use with preschool children.

A Canadian study by Clark et al. (48) further demonstrated the effectiveness of semiannual applications of fluoride varnish to primary teeth. After 32 months, children who received fluoride varnish (Durafluor®) had 27.2 percent fewer carious primary molars compared to a control group. The authors reported that one 10 ml tube of varnish was sufficient to treat approximately 20 children, and calculated that the use of fluoride varnishes appears to result in less fluoride ingestion than results from the use of APF gels. In 1994 Weinstein et al. (49) reported on the results of a trial using fluoride varnish to prevent baby bottle tooth decay in a group of high-risk children enrolled in a WIC program. As part of that study, 133 children between the ages of 12 and 24 months received a single application of fluoride varnish. Six months later, 16 percent of children had new carious lesions. Although there was no control group in this study, the authors concluded that the caries rate following a single fluoride varnish application was less than had previously been measured for a similar group of high-risk children (30%).

The introduction of fluoride varnish applications into preventive programs for young children has multiple advantages: (1) no special equipment is needed for the application; (2) teeth do not need a professional prophylaxis prior to varnish application; (3) the potential ingestion of fluoride is low (very little is used per application); (4) fluoride varnishes can prevent decay in both smooth surface and pit and fissure sites; and (5) dental hygienists generally can apply the varnish without direct supervision.

Fluoride varnish applications should be readily adaptable to both WIC clinic settings and to Head Start programs. In Head Start programs, fluoride varnish applications could be carried out two times a year for all enrolled children, and more frequently for children at highest risk for caries. In WIC clinics, fluoride varnish applications could similarly occur two or more times a year, for all dentate children, coinciding with other appointments.

Chlorhexidine and Caries Prevention. For more than 70 years, we have known that the primary pathogen responsible for dental decay is mutans streptococci (50). Yet, most of the preventive strategies commonly employed to prevent dental decay (fluorides, sealants, dietary modification, oral hygiene) do little to suppress this pathogen. Chlorhexidine is an antimicrobial agent that suppresses mutans streptococci, and research has shown promising uses for chlorhexidine in the prevention of caries in children.

Gisselsson et al. (51) reported a 38 percent reduction in approximal caries in children receiving chlorhexidine gel treatments compared to a control group. One hundred seventeen preschool children participated in this study, beginning at age 4 years. Children in the experimental group had 1 percent chlorhexidine gel applied interdentally using dental floss, four times a year, for three years. The time required per treatment was approximately 10 minutes per child. The authors reported that the flossing-gel technique used in the study is effective, simple, inexpensive, and does not require professional dental equipment. In another report, Achong et al. (52) evaluated the ability of chlorhexidine to suppress mutans streptococci in 40 4- to 12-year-old children. All of the children in this study had active caries and high levels of mutans streptococci. Children in the treatment group wore mouthguards that were coated with a 3.0 percent chlorhexidine varnish to bed each night for seven nights. Children in the control group wore mouthguards coated with a placebo varnish. The chlorhexidine varnish group resulted in a significant reduction in mutans streptococci levels for up to three months following the intervention. The authors reported that the treatment was well received by the majority of parents and patients, and that compliance in wearing the mouthguards was favorable.

Köhler et al. (53) reported on the ability of chlorhexidine to suppress mutans streptococci levels in mothers, and thus to delay transmission of mutans streptococci to their children. Mothers with high mutans streptococci counts and with first-born babies aged 3–8 months were selected for study. All mothers received a preventive program consisting of dietary counseling, professional tooth cleaning, oral hygiene instruction, fluoride treatment, and excavation of large cavities. Subjects with high mutans streptococci levels, even after this preventive program, were prescribed 1.0 percent chlorhexidine gel to be administered in a custom-made mouthguard for five minutes a day over a two-week period. Mothers whose mutans streptococci levels were successfully reduced by the basic preventive program did not receive the chlorhexidine treatment, and served as a control group in the study. Mothers in both groups were recalled every four months during the study, and those who demonstrated high mutans streptococci levels at subsequent appointments were retreated with chlorhexidine and/or a repeat of the basic preventive program. Their infants were tested for the presence of mutans streptococci beginning at 15 months of age and at four-month intervals thereafter. The results of this study indicated that at age 23 months, fewer infants had been infected with mutans streptococci in the chlorhexidine group compared to the control group (11% vs 45%, respectively).

A second study by Köhler et al. (54) reported on mutans streptococci and caries in the same group of children at age 3 years. A significant difference in the percentage of children who tested positive for mutans streptococci remains, with fewer children whose mothers received the chlorhexidine treatment testing positive for mutans streptococci compared to the control group (41% vs 70%, respectively). When a clinical exam for caries was done on these same children at age 3, only 6 percent of children in the experimental group were found to have detectable decay, compared to 43 percent of children in the control group. Also of importance was the finding that 77 percent of the children who were infected early with mutans streptococci had developed caries, compared to 33 percent of children who did not test positive for mutans streptococci until age 3 years. This study revealed that early transmission of mutans streptococci from mother to child leads to higher risk of caries for children and that a relatively simple protocol for chlorhexidine treatment in mothers with high levels of mutans streptococci can result in delayed transmission of mutans streptococci to their children.

While chlorhexidine varnishes and gels are not yet commercially available in the United States, a discussion of their potential merit as caries-preventive agents has been included here in anticipation of future FDA approval. Achong et al. (52) have reported that US Food and Drug Administration approval is currently being requested for two chlorhexidine varnish systems for use in the United States.

Sealants. A multitude of clinical trials during the past several decades have proven pit and fissure sealants to be safe and highly effective in preventing tooth decay (55). Despite their effectiveness, however, sealant utilization has remained low, especially for low-income children. Sealants remain the single most effective means we have for preventing caries in pit and fissure surfaces and therefore should be considered an important component of any preventive dentistry program.

While most published data on the effectiveness of sealants refer to their use on permanent teeth, sealants on primary teeth also can be effective. Hardison et al. (56) reported on the effectiveness of pit and fissure sealants in a group of 1,871 children enrolled in Head Start programs in Tennessee. All sealants in the study were placed at Head Start centers using portable equipment. The retention rate after one year was 88.2 percent overall, with some centers having retention rates of 92.5 percent or higher. The authors found that 3- and 4-year-old children enrolled in the study were able to tolerate the sealant procedure well, with only about 5 percent of children either resisting or refusing.

As a preventive measure, sealants are more costly than other preventive regimens, primarily due to operator costs (57). When targeted only to highest-risk patients (e.g., those with identifiable precavity lesions in pit and fissure sites), however, they may be cost effective, especially compared to restorations. Besides targeting sealants in public programs to children at highest risk, one of the most effective means for making sealant programs cost effective is to use dental auxiliaries for their placement. Studies have demonstrated that dental auxiliaries can place sealants as effectively as dentists (58-60).

A recent article gives further reason to consider the inclusion of sealants in preventive programs. Mass et al. (61) found that by placing sealants on occlusal surfaces of first permanent molars in 6–8-year-olds, mutans streptococci levels were significantly reduced up to six months later. It is therefore reasonable to assume that the preventive effects of pit and fissure sealants can have carryover effects to other sites in the mouth.

Recommendations

Early screening, risk assessment, and preventive programs in WIC, Head Start, and Early Head Start populations hold a great deal of promise for preventing dental decay in children who are not only high risk, but who also are unlikely to access preventive dental care through more traditional channels. Wherever possible, risk assessment and preventive programs should be supported by scientific literature that documents both the successes and limitations of various methods and interventions. Based on the review undertaken for the current paper, the following recommendations for caries preventive programs in WIC, Head Start, and Early Head Start can be made.

1. WIC, Head Start, and Early Head Start programs can enable access

to preventive dental care for many children at high risk for dental caries who often lack access to preventive dental care through more traditional routes. WIC, Head Start, and Early Head Start should be encouraged to expand their involvement in promoting oral health and their linkages to practitioners and programs that serve the oral health needs of children.

2. Dentists, hygienists, nurses, other appropriate personnel, and parents should be taught to screen infants and preschool children to assess caries risk. Screenings should take place early and often. Employ aids including "Lift the Lip" video in training.

3. Continuous attempts should be made in WIC, Head Start, and Early Head Start programs to find a dental home for each child to maximize their potential to receive continuous diagnostic, preventive, restorative, and emergency care throughout childhood.

4. In general, all children enrolled in WIC, Head Start, and Early Head Start should be considered at high risk for dental decay. Individual risk assessment should be conducted as part of routine screenings to identify children needing restorative care and to identify children at highest risk for caries that will benefit from more costly and time-consuming preventive strategies (e.g., sealants and, eventually, chlorhexidine gels and varnishes).

5. WIC, Head Start, and Early Head Start preventive dental programs should not rely solely on educational strategies because little evidence supports the ability of educational efforts alone to prevent dental caries.

6. Daily brushing with fluoridated toothpaste, followed by minimal or no rinsing, should be incorporated into Head Start programs, and other programs serving high-risk 3–5-year-olds.

7. Fluoride varnish application should become a routine part of preventive dental programs associated with Head Start and WIC programs. Children in these programs should receive two or more fluoride varnish applications a year. Applications can be done on site.

8. Chlorhexidine gels and varnishes show great promise, once FDA approval for their use is granted in this country. WIC and Early Head Start programs should promote their use, as well as the use of chlorhexidine mouth rinses with pregnant women and young mothers to delay the transmission of mutans streptococci from mother to child. Chlorhexidine gels and varnishes should be considered for use with 3–5-year-old Head Start children who have active caries or who are determined to be at highest risk.

9. Sealant application should be recommended for 3–5-year-old children served by Head Start who are considered to be at highest risk, or to all participants as resources allow.

10. Increased research activity in caries prevention using WIC, Head Start, and Early Head Start populations and settings should be encouraged. Information regarding successful preventive programs in WIC, Head Start, and Early Head Start (best practices) should be disseminated broadly.

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